AMENDMENT(S) TO THE SPECIFICATION

Please insert the following paragraph at page 1, line 3:

CROSS REFERENCE TO RELATED APPLICATION

The present application is a 35 U.S.C. §§ 371 national phase conversion of PCT/DE2003/003868, filed 21 November 2003, which claims priority of German Application No. 102 55 992.9, filed 30 November 2002. The PCT International Application was published in the German language.

Please replace the paragraph beginning at page 1, line 3, with the following rewritten paragraph:

BACKGROUND OF THE INVENTION

The invention ~~is focused on~~ concerns a barrel-shaped bearing having an external ring, ~~and~~ an internal ring, ~~having~~ and at least one row of barrel-shaped rolling bodies arranged ~~in~~ between the rings. At~~, and having at~~ least one disk-shaped cage which revolves together with the rolling bodies, engages in an encircling groove of the rolling bodies of one row and, on its outer circumference, has a number of recesses corresponding to the number of rolling bodies of a row thereof.

Please replace the paragraph beginning at page 1, line 11, with the following rewritten paragraph:

An arrangement of the generic type can be seen in German patent specification 663 179. This reference shows a spherical roller bearing, with ~~the~~ rolling bodies having a stepped cross section and rolling with their distal regions on the external ring and their proximal regions on the internal ring. However, in ~~the case of~~ this arrangement, first, ~~of all~~ an unfavorable force profile is produced by the rolling bodies being subjected not only to compressive stress but also to bending stress, and secondly, the axial space required by this bearing is comparatively large. However, the fact that, even if there is a small pivoting of the external ring in relation to the remaining bearing components, as is possible ~~in the case of~~ for barrel-shaped bearings, one of the two contact surfaces between the rolling bodies and the outer ring can rapidly wear away, which is an even more serious disadvantage.

Due to the transverse moments acting on the rolling bodies, this results in ~~an~~ instability of the relevant, barrel-shaped rolling body which may prevent ~~the~~ their return ~~thereof~~, which is required during further rotation of the bearing, to the running surface of the external ring and in such a case will lead to the destruction of the bearing. ~~Neither is~~ Further, the disk-type cage in unable ~~able~~ to provide any sort of stabilization ~~here~~, since it guides the rolling bodies exclusively in ~~the~~ their tangential position ~~thereof~~, but not in the radial direction.

Please replace the paragraph beginning at page 2, line 10, with the following rewritten paragraph:

SUMMARY OF THE INVENTION

The disadvantages of the described prior caused development of ~~are result in the problem initiating~~ the invention of ~~developing~~ a barrel-shaped bearing of the known general ~~generic~~ type ~~in~~ but such ~~a manner~~ that, even if there is a considerable ~~pivoting~~ tilting or swinging of the external ring relative to the remaining parts of the barrel-shaped bearing, the rolling bodies can remain stable and, on further rotation of the bearing, those bodies can always return ~~again~~ to the center of the running surface of the external ring.

Please replace the paragraph beginning at page 2, line 18, with the following rewritten paragraph:

This problem is solved for a ~~in the case of the~~ barrel-shaped bearing of the ~~generic~~ general type by providing the entire running surface of the internal ring ~~having~~ with a concave cross section over the entire axial length of a rolling body,[[;]] and by the ~~smallest~~ shortest distance between the two sides ~~of~~ in a recess of the disk-type cage for receiving a rolling body being smaller in the region of the outer circumference ~~thereof~~ of the cage than the diameter of ~~a~~ the rolling body in the region of ~~the~~ a groove encircling the ~~latter~~ rolling body.

Please replace the paragraph beginning at page 3, line 1, with the following rewritten paragraph:

These two measures complement each other ~~insofar as, firstly,~~ because no transverse or tilting moments act on the rolling bodies because surface regions of the rolling bodies, which regions lie opposite one another in the radial direction, conduct the radial forces to the two bearing rings, so that the rolling bodies remain stable even when the bearing components tilt or swing ~~pivot~~ greatly. In addition, ~~owing to~~ the disk-shaped cage[[,]] prevents the rolling bodies ~~cannot become~~ from becoming detached from the bearing even if ~~they~~ the rolling bodies temporarily lose complete contact with the external ring. The bearing according to the invention therefore operates satisfactorily even if the pivoting of the bearing components exceeds ~~the~~ customary limit values.

Please replace the paragraph beginning at page 3, line 14, with the following rewritten paragraph:

By designing the (greatest) width of the groove encircling the rolling body between the regions of the rolling-body circumferential surface to have ~~with~~ the largest cross section making up only approximately one quarter to one tenth of the axial overall length of the rolling body, a high (radial) load-bearing capacity of a rolling body is produced. As[[,]] ~~as~~ a result, ~~of which~~ a barrel-shaped bearing of this type is very stable in comparison with its axial extent.

Please replace the paragraph beginning at page 3, line 22, with the following rewritten paragraph:

It has proven ~~favorable~~ beneficial for the distance ~~of~~ between the base of a recess of the disk-type cage ~~from~~ to the internal circumference ~~thereof~~ of the cage to be smaller than the depth of the groove in a rolling body. As a result, the desired, purely concave cross-sectional geometry of the running surface of the internal ring is possible.

Please replace the paragraph beginning at page 4, line 4, with the following rewritten paragraph:

By the maximum (radial) width of the annular disk-type cage ~~being greater~~ between the inner and outer circumferential circle thereof being greater than half of the diameter of a rolling body in the region of the groove encircling ~~of~~ the ~~latter~~ rolling body, the rolling bodies can be engaged around at ~~the~~ mutually diametrically opposite regions of the groove base and can thus be securely held even if the external ring is ~~pivoted~~ tilted to a very great extent relative to the remaining bearing components.

Please replace the paragraph beginning at page 4, line 13, with the following rewritten paragraph:

The maximum (radial) width of the annular disk-type cage between the inner and outer circumferential circle thereof should preferably be equal to the diameter of a rolling body in the region of the groove encircling the ~~latter~~ body, or should be greater than ~~said~~ that diameter, in order, firstly, to be able to obtain sufficient stability despite the recesses ~~on~~ in the external circumference of the cage and, secondly, to be able to securely engage around the individual rolling bodies.

Please replace the paragraph beginning at page 5, line 4, with the following rewritten paragraph:

If - as the invention furthermore provides - the sides of a recess in the region of the external circumference of the disk-type ~~case~~ cage converge in the radial direction thereof (as seen to the outside), then the functions of the smooth-running rotatability of the rolling bodies, on the one hand, and the secure mounting thereof, on the other hand, are combined with one another in an advantageous manner.

Please replace the paragraph beginning at page 5, line 11, with the following rewritten paragraph:

Further advantages arise from the fact that a recess ~~of~~ in the disk-type cage is ~~edged~~ defined by a curve of constant curvature (in some regions). The radius of curvature r_s of this curve should be somewhat larger than half of the diameter of a rolling body in the region of the groove base ~~thereof~~ the rolling body, so that a (small) play is ensured so that the relevant rolling body can rotate in a smooth-running manner.

Please replace the paragraph beginning at page 6, line 2, with the following rewritten paragraph:

A further advantageous feature of the invention comprises ~~resides in the fact that~~ the encircling groove in the circumferential surface of a barrel-shaped rolling body ~~has~~ having side surfaces which are mutually parallel or which diverge outward from each other. In order to ensure that the rolling bodies rotate relative to the disk-type cage in a manner which is as free from friction as possible, the width of the groove in the circumferential surface of a barrel-shaped rolling body should be somewhat greater than the (axial) width d of the disk-type cage. On the other hand, in particular load situations, individual rolling bodies can be forced into a tilting movement in relation to the disk-type cage, and a movement of this type may, if appropriate, be facilitated by a groove shape having outwardly diverging side surfaces.

Please replace the paragraph beginning at page 9, line 13, with the following rewritten paragraph:

BRIEF DESCRIPTION OF THE DRAWINGS

Further features, details, advantages and effects on the basis of the invention emerge from the description below of preferred embodiments of the invention and with reference to the drawing, in which:

Fig. 1 shows an end view of a barrel-shaped bearing according to the invention;

Fig. 2 shows a section through ~~fig.~~ Fig. 1 along the line II-II;

Fig. 3 shows an illustration corresponding to fig. 2 with the radii of convexity plotted in;

Fig. 4 shows a perspective view of the barrel-shaped bearing from ~~fig.~~ Fig. 1, with the external ring having been partially broken up, so that the view of the rolling bodies held by the cage is opened up;

Fig. 5 shows an illustration corresponding to ~~fig.~~ Fig. 4, with some of the rolling bearings having been removed from the exposed cage;

Fig. 6 shows a side view of the circumferential surface of a rolling body removed, according to ~~fig.~~ Fig. 5, from the cage;

Fig. 7 shows an illustration corresponding to ~~fig.~~ Fig. 6 of a modified embodiment of the invention;

Fig. 8 shows a plan view of a segment broken out of the cage from ~~figs.~~ Figs. 4 and 5; and

Fig. 9 shows an illustration corresponding to ~~fig.~~ Fig. 8 of an embodiment of the invention which has in turn been modified.

Please replace the paragraph beginning at page 10, line 16, with the following rewritten paragraph:

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a barrel-shaped bearing 1 according to the invention having an external ring 2, an internal ring 3 and a row of barrel-shaped rolling bodies 4 which are arranged in between the rings and are held at approximately equidistant distances by an encircling cage 5.

Please replace the paragraph beginning at page 11, line 2, with the following rewritten paragraph:

During the tilting of the external ring 2 relative to the remaining bearing components 3 to 5, the cage 5 keeps the rolling bodies ~~(4)~~ 4 in their position. So that it does not, on the other hand, obstruct either the tilting movement of the external ring 2 or the movement of the rolling bodies 4, it extends through an encircling groove 7 of each rolling body 4, as illustrated in ~~figs.~~ Figs. 2 and 3.

Please replace the paragraph beginning at page 11, line 10, with the following rewritten paragraph:

The cage 5 can be produced from a disk with a constant thickness d, for example can be punched out of a metal sheet. As ~~fig.~~ Fig. 8 shows, a number of recesses 9 corresponding to the number of rolling bodies 4 are cut out from the radially outer circumference 8 of an annular basic structure with a constant, radial width ~~from the radially outer circumference 8. These recesses each accommodate~~ Each recess accommodates one rolling body 4.

Please replace the paragraph beginning at page 11, line 17, with the following rewritten paragraph:

The internal circumference 10 of the disk-shaped cage 5 preferably corresponds to the maximum external circumference of the internal ring 3, in particular at an edge 11 of the running surface 12 ~~thereof~~ of the ring, so that the cage 5 can easily be pulled over the internal ring 3, for example mechanically. The insertion of the rolling bodies 4 into the recesses 9 of the disk-shaped cage 5 can likewise be brought about automatically, and the inserted rolling bodies 4 then ~~being~~ are held in situ because they are engaged around in the region of the relevant groove base 13 by the cage 5. After the external ring 2 has been pulled over into a position tilted, for example, by 90° and has been pivoted into the plane of the internal ring 3, the assembly of the barrel-shaped bearing 1 is finished.

Please replace the paragraph beginning at page 14, line 8, with the following rewritten paragraph:

It can be seen in ~~fig.~~ Fig. 4 that even if the external ring 2 is broken away, the rolling bodies 4 are held in situ by the cage 5. This is achieved by the form-fitting connection of the recesses 9 of the cage 5 with the groove regions 7 of the rolling bodies 4.

Please replace the paragraph beginning at page 14, line 13, with the following rewritten paragraph:

Two possible groove shapes are illustrated in ~~figs.~~ Figs. 6 and 7[[: in]]. In the ~~case of the~~ embodiment according to ~~fig.~~ Fig. 6, the groove 7 has planar side surfaces 21, that are produced, for example, by ~~means of~~ a straight plunge cut. Accordingly, the width b_N of the groove 7 is approximately constant. The groove base 13 follows a cylindrical circumferential surface area with the radius of curvature r_N. The transition regions between the groove base 13 and groove side surfaces 21, between the latter and the circumferential surface areas 16 and between the circumferential surface areas 16 and end surfaces 14 are rounded in order to avoid burrs and stress concentrations.

Please replace the paragraph beginning at page 14, line 25, with the following rewritten paragraph:

The embodiment of a rolling body 22 according to ~~fig.~~ Fig. 7 differs from that according to ~~fig.~~ Fig. 6 exclusively by ~~virtue~~ of the fact that the groove side surfaces 23 run along conical circumferential surface areas. This involves very blunted cones having preferably identical opening angles a of virtually 180° in each case (for example 170° to 179°). Accordingly, the groove side surfaces 23 diverge from each other at an angle β, as viewed along a radial plane to the outside from the axis of symmetry 24. In this case: $\beta = (180° - a)$ in the case of identical opening angles a of both groove side surfaces 23, and in the case of different opening angles a_1, a_2: $\beta = (180° - (a_1 + a_2)/2)$. The (axial) width of the groove base is in turn b_N and its radius of curvature is r_N. With the same values

for b_N and d, this embodiment tolerates relatively large offset angles of the barrel-shaped rolling bodies 22 and therefore results in a smaller amount of wear when subjected to corresponding stresses.

Please replace the paragraph beginning at page 15, line 17, with the following rewritten paragraph:

A cutout from the cage 5 is reproduced in ~~fig.~~ Fig. 8. Recesses 9 which are in the form of an arc of a circle and have a constant radius of curvature r_S can be seen. By means of $r_S > r_N$ and $d < b_N$, a rotational movement of the rolling bodies 4, which is as free as possible from friction, in relation to the cage 5 is ensured. In order to be able to secure the rolling bodies, the circumference 25 of a recess 9 extends over an arc of a circle of more than 180°, for example of between 200° and 230°, in particular of 210° to 220°, so that the end regions 26 of the recess circumference 25 converge, in the viewing direction from the internal circumference 10 of the cage 5 towards its external circumference 8. The minimum distance of the end regions 26 is smaller than the diameter ($2 * r_N$) of the rolling bodies 4 in the region of the groove base 13, so that the rolling bodies 4 are engaged around in a form-fitting manner. In order to release a rolling body 4 from the cage 5, the former has therefore to be pulled outward with a large force in order (temporarily) to push the end regions 26 of the recess circumference 25 apart. The end regions 26 therefore form snap-in lugs for snapping in the rolling bodies 4.

Please replace the paragraph beginning at page 16, line 25, with the following rewritten paragraph:

The modified disk-type cage 27 from ~~fig.~~ Fig. 9 has a similar effect. This cage differs from the cage 5 according to ~~fig.~~ Fig. 8 exclusively by the recess circumference 28, which has the radius of curvature r_S in its region 29 facing the inside 10 of the cage 27, having, approximately level with its radial profile, flattened (approximately mutually parallel) regions 30 (having a length l, of for example $r_S/3$) which are then adjoined by the actual snap-in lugs 31, which are in turn curved and converge towards each other and the radius of curvature of which can be selected to coincide with

r_s. This embodiment tolerates relatively large radial offsets of the cage 27 with respect to the rolling bodies 4, which offsets may occur, for example, as a consequence of sharp temperature fluctuations, but without the rolling bodies 4 being able to be released if the external ring 2 tilts sharply. As in the case of the cage 5, the edges of the recess circumference 32 are also cross-sectionally rounded here.